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# ***An Analysis of the Possible Association Between Sulphur in Gasoline and Adverse Health Outcomes***

**An Overview Report by an Expert Scientific Panel**

**FINAL REPORT**

**October 12, 1998**



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## **TABLE OF CONTENTS**

	<b>Page</b>
<b>EXECUTIVE SUMMARY</b>	<b>i</b>
<b>EXPERT SCIENTIFIC PANEL</b>	<b>iii</b>
<b>1.0 INTRODUCTION AND OBJECTIVES</b>	<b>1</b>
1.1 Focus of Current Expert Panel Report	2
<b>2.0 PUBLIC HEALTH MANAGEMENT FRAMEWORK</b>	<b>3</b>
<b>3.0 CRITERIA FOR EVALUATING CAUSALITY OF ASSOCIATION AND JUDGING UNCERTAINTY</b>	<b>5</b>
3.1 Causality of Association	5
3.2 Judging Uncertainty	7
<b>4.0 APPLICATION OF THE PUBLIC HEALTH FRAMEWORK</b>	<b>9</b>
4.1 General Issues	9
4.1.1 Exposure to Air Pollutants	9
4.1.1.1 Composition of Air Pollution	10
4.1.1.2 Factors Affecting Air Concentrations of Pollutants	11
4.1.2 General Uncertainties in Causal Associations between Disease and Air Pollution	11
4.1.2.1 Disease End-Points	11
4.1.2.2 Uncertainties in Exposure-Response Assessments to Specific Air Pollutants	14
4.2 Examples from Specific Studies of the Uncertainties in the Causal Association Between Air Pollutants and Adverse Health outcomes	15
4.2.1 Time-series Data And Exacerbation of Short-Term Health Conditions	15
4.2.2 Time-Series Data And Short-Term Health Outcomes Leading To Morbidity	17
4.2.3 Panel Studies of Asthmatics and People at Risk for Respiratory Effects from Pollutant Exposure	22
4.2.4 Controlled Exposures to Acid and Sulphate Irritants	23



## TABLE OF CONTENTS (Continued)

	Page
5.0 CONCLUSIONS .....	26
5.1 Likelihood of Causality of Association between Sulphur in Gasoline and Adverse Health Outcomes .....	26
5.1.1 Exposure Estimation and Exposure-Response Characteristics .....	26
5.1.1.1 Estimation of Air Concentrations of Pollutants .....	26
5.1.1.2 Correlation between Environmental Measurements and Personal Exposure .....	27
5.1.1.3 Types of Exposure-Response Relationships Assumed .....	28
5.1.2 Characteristics of Diseases Affected by Air Pollution .....	31
5.2 Magnitude of Changes in Air Pollution Parameters Expected by Limiting Sulphur in Gasoline .....	31
5.3 Major Conclusions .....	32
6.0 IMPLEMENTATION OF OPTIONS FOR THE MANAGEMENT OF PUBLIC HEALTH IMPACTS OF AIR POLLUTION .....	35
6.1 Exposure-Based Management Strategies .....	36
6.2 Disease Surveillance and Disease Intervention Management Strategies .....	38
7.0 REFERENCES .....	39



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## EXECUTIVE SUMMARY

Environment Canada is planning to promulgate regulations to limit the concentrations of sulphur in gasoline. The rationale for these regulations is based largely on the supposed associations between vehicular sulphur emissions and adverse human health outcomes predicted by the Health and Environmental Effects Panel (HEEP, 1997). HEEP (1997) relied on selected studies from the available epidemiological literature that focussed on testing the possible association between sulphate air pollutants and adverse health outcomes. HEEP (1997) considered sulphate to be an overall surrogate for other vehicular emissions and followed the hypothesis that the reduction of sulphur in gasoline would coincidentally reduced other emissions from vehicles, thereby leading to economic benefits from improvements in public health.

This report summarizes an analysis, conducted by an Expert Scientific Panel of clinical respirologists and epidemiologists, of the likelihood of a causal association between sulphur in gasoline and adverse health outcomes or conditions. The methodology used in this analysis involved the application of the Public Health Management Framework that has been used traditionally to effectively manage human diseases. Such a framework is being adopted by Health Canada as one part of the underpinnings of the proposed Canada Health Act. Long-standing scientific principles for the analyses of the likelihood of causality of association, including the uncertainties in the available information, were used in the application of the available published data to the Public Health Management Framework.

The conclusions of the Expert Scientific Panel are:

- i) Except for ozone, the uncertainties in the available epidemiological information are too great to conclude there is a reasonable likelihood of a causal association between specific components of air pollution, including sulphates, and adverse health outcomes or conditions.
- ii) Due to the large uncertainties leading to our first conclusion expressed above in i), plus the observation of the extremely small contributions of sulphur from gasoline to total sulphate emissions into the environment from all sources, the evidence is not persuasive that limiting the sulphur concentrations in gasoline *per se* would result in measurable improvements in public health.
- iii) Due to the large uncertainties leading to our first conclusion expressed above in i), plus the small reductions in other air pollutants in vehicular emissions that could be expected from reducing the concentrations of sulphur *per se* in gasoline, sulphate does not appear to be a good surrogate for total air pollutants, contrary to the conclusion by HEEP (1997).



- iv) The available information provides reasonable evidence of the likelihood of a causal association between episodic elevations in total air pollution and adverse public health outcomes related to the exacerbation of preexisting diseases, particularly of the respiratory system, and possibly the cardiovascular system.
- v) Based on conclusion iv), plus the information showing the contribution of vehicular emissions, combined with specific meteorological conditions, to episodes of elevated air pollution, the control of vehicular emissions is important in reducing adverse health outcomes from total air pollution.
- vi) There may be technical reasons for the limitation of sulphur in gasoline to ensure the successful operation of vehicle emission control systems to achieve the objectives of conclusion v); however, these reasons are unrelated to any direct health benefits that could be derived from limiting the concentrations of sulphur in gasoline *per se*.
- vii) Effective strategies can be implemented to immediately produce reductions of adverse health outcomes from total air pollution. Several management strategies particularly in the areas of exposure management, and disease surveillance and intervention are briefly discussed in this report.

We agree with the analysis of the HEEP (1997) report that the overall analysis of the available information shows there is a reasonable likelihood of causality of association between total air pollution and adverse health outcomes. The major reasons for the difference between the final conclusions of the HEEP (1997) report and those from the analysis in our report, arise from the following:

- i) The selection by HEEP (1997) of specific studies on sulphates for their analyses, without using the weight of available evidence from all available epidemiological studies, including clinical-type exposure studies, to analyse the uncertainties of the likelihood a causal association between sulphates and adverse health outcomes.
- ii) The reliance of HEEP (1997) on sulphates as a surrogate for emission reductions, in the face of the extreme uncertainties of the likelihood of causal association between sulphates and adverse health outcomes.
- iii) The rejection by HEEP (1997) of the existence of a threshold exposure-response relationship, even though such a relationship is clearly demonstrated in clinical-type chamber studies, with other pollutants such as ozone and sulphur dioxide where exposures are known.

The above reasons for the differences in conclusions mean it is highly unlikely that measurable improvements in public health protection can be achieved by following the recommendations in the HEEP (1997) report for stringent limitations of the concentrations of sulphur in gasoline, taken in isolation, without consideration of other sources of air pollution.



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This report was prepared under the guidance and scientific direction of the Expert Scientific Panel as identified on the previous page. The panelists were selected to provide scientific expertise in statistical epidemiology, clinical testing, medicine and toxicology; and practical clinical experience with diseases of relevance to air pollution. The panelists was divided into two groups:

- i) The Document Preparation Expert Scientific Panel provided scientific advice during the preparation of the report, and addressed critical scientific issues pertinent to the objectives of the report; and
- ii) The Peer Review Expert Scientific Panel reviewed the report, and provided a critical analysis of the issues prior to finalization of the report.

Cantox Environmental Inc. provided the scientific support for the Expert Scientific Panels, and was responsible for the details of assembling and organizing this report, and ensuring that the interpretation of the scientific information and conclusions of the report reflected the views and opinions of all panelists. The responsibilities of specific staff of Cantox Environmental Inc. were as follows:

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